Historical and Statistical Account of the present System of Supplying the Metropolis with Water.

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The following pages contain the results of an endeavour, with limited time and opportunities, to supply a statement to accompany the account of the present System of Sewerage in the Metropolis, read before this Society on the 18th of March last. "Anciently, until the time of the Conqueror, and 200 years after, this city of London was watered (besides the famous river of Thames on the south part) with the River of the Wells, as it was then called, on the west; with a water called Wall Brook, running through the midst of the city into the river of Thames, severing the heart thereof; and with a fourth water or boorn, which ran within the city through Langboorn Ward, watering that part in the east. In the west suburbs was also another great water called Oldborn, which had its fall into the River of Wells. Then were there three principal fountains or wells in the other suburbs; to wit, Holy Well, Clement's Well, and Clark's Well. Near unto this last-named fountain were divers other wells, viz., Skinner's Well, Fag's Well, Tode Well, Loder's Well, and Rad Well; all which having the fall of their overflowing into the aforesaid river, much increased the stream, and in that place gave it the name of Wells. In West Smithfield there was a pool, in records called Horse Poole, and one other near unto the parish church of St. Giles without Cripplegate; besides all which they had in every street and lane of the city, divers wells and fresh springs; and after this manner was this city then served with sweet and fresh water; which, being since decayed, other means have been sought to supply the want, as shall be showed."*

"The bourns aforenamed, and other the fresh waters that were in and about this city, being in process of time, by encroachment for buildings, and otherwise heightening of grounds, utterly decayed, and the number of citizens mightily increased, they were forced to seek sweet waters abroad; whereof some, at the request of King Henry III., in the 21st year of his reign, were (for the profit of the city, and good of the whole realm thither repairing, to wit, for the poor to drink and the rich to dress their meat) granted to the citizens and their successors by one Gilbert Sanford, with liberty to convey water from the town of Tyburn by pipes of lead into the city. And the first cistern of lead, castellated with stone, in the city of London, was the Great Conduit, in West Cheap, which was began to be builded in the year 1285;" and was supplied with water from these newly acquired sources.†

For a century and a half the conduits erected in different parts of the city appear also to have been supplied from them; but in 1438, the corporation brought water from Highbury to a conduit opposite Cripplegate Church. In the following year, the supply to the cisterns at Tyburn was augmented by the waters of some springs at Paddington, obtained from the Abbot of Westminster; and this continued to be the only great source of supply, until the middle of the sixteenth century, although the water of various springs in the neighbouring fields were brought to particular buildings or localities in the city; the conduits at Holborn

* Strype's Stow, pp. 22, 23. † Ibid. p. 24.

Cross and on Snow Hill, deriving their water from the springs collected into Lamb's Conduit, near the present Red Lion-street; that at Aldgate, from springs at Hackney; one in Lothbury, from springs between Hoxton and Islington; the Charter House, from White Conduit Fields; and Christ's Hospital, from the Devil's Conduit, north-east of the present Brunswick-square.

Notwithstanding the readier access to the well waters, obtained by the multiplication of pumps, and the still continued use of the Thames water carried up into the city, the corporation found it necessary to go yet further afield in search of additional springs; and in 1543, an Act was passed to enable them to bring water from Hampstead Heath, St. Mary-le-Bone, Hackney, and Muswell Hill, upon their compensating the owners of land for damage done by digging or otherwise. It was not until 1568 that Thames water was raised by machinery for the supply of any part of the town; but in that year a gin, probably a horse-wheel, was constructed to supply a conduit near the top of Dowgate Hill.

"The conduits used, in former times, to be visited, as they were in a more remarkable manner on the 18th of September, 1562. The lord mayor (Harper), aldermen, and many worshipful persons, and divers of the masters and wardens of the twelve companies, rid to the Conduit Heads, for to see them, after the old custom; and afore dinner they hunted the hare, and killed her, and thence to dinner at the head of the conduit. There was a good number entertained with good cheer by the chamberlain; and after dinner they went to hunting the fox: there was a great cry for a mile, and at length the hounds killed him at the end of St. Giles's. Great hallowing at his death, and blowing of hornes; and thence the lord mayor, with all his company, rode through London to his place in Lumbard-street."*

Thus the corporation of London, down to the reign of Elizabeth, regarded it as one of their principal duties to supply the town with water, and see to the erection and preservation of conduits, to which the poor could freely resort. Down to this period, it must likewise be borne in mind that the city and its immediate suburbs formed the whole Metropolis. The best description which I can find of the transition from this system of public supplies to that acting by private companies, is contained in a paper by a member of this Society, Mr. Thomas Wicksteed, engineer to several of the Water Companies, read before the Society of Arts on the 24th of May, 1835.

"Although bringing water by means of pipes from distant sources was a great improvement, so far as respected an increased quantity; nevertheless, the inconvenience and expense of carrying it from the conduits to each house still existed, and it was not until the erection of the London Bridge Water-works, in 1582, that this difficulty was overcome, when the principle of conveying water into dwelling-houses by means of small lead pipes was adopted; this, the greatest improvement in the mode of supplying water, by substituting the power of machinery for human drudgery, has not been surpassed, and is the plan now used, two centuries and a half after its first introduction—improvements have been made in the practice of it,—the principle remains unaltered.

"In 1581 or 1582, Peter Maurice, a Dutchman, obtained a lease from the city of the first arch of London Bridge, on the north side, and

* Strype's Stow, p. 25.

erected a water-wheel, to be worked by the tide, and a set of force pumps to raise Thames water for the supply of the neighbourhood. The water was raised to the top of a wooden building 120 feet high, and passed from thence through pipes to supply the dwelling-houses in Thames-street, New Fish-street Hill, and Gracechurch-street, as far as a standard on Cornhill, which was erected in the middle of the street where the four ways meet. The water which was to spare, after supplying the before-named streets, flowed from the standard through four pipes branching to Bishopsgate, Aldgate, the Bridge, and Wallbrook, which supplied the dwelling-houses in the neighbourhood, and cleansed the gutters in these streets. The site of the standard was supposed to be the highest ground in the city. The quantity of water raised was equal to about 3,170,000 imperial barrels per annum, or an average quantity of 216 gallons per minute, or about $\frac{7}{8}$ths per cent. of the quantity raised by the water-works for the supply of the metropolis at present (in 1834). There were 16 pumps worked by this wheel, each of 7 inches diameter, and 30 inches stroke. Mr. Smeaton ascertained from registers that the pumps made 3,025 strokes per tide; and as there are 708 tides per annum (allowing one-fifth for loss through the valves, according to Dr. Desagulier's statements), the quantity raised may be calculated. Improvements, however, had been made before the above particulars of the pumps were published, and therefore the quantity given will be the extreme probable quantity raised in 1582. In 1583 or 1584 machinery was fixed in the second arch.

"In 1594, for the better supply of the city, Bevis Bulmar erected a large horse-engine and four pumps at Broken Wharf, to raise Thames water for the inhabitants of Cheapside, St. Paul's Churchyard, Fleet-street, &c., which, Maitland says, was removed previous to the date of his work, 1756, on account of other companies being able to supply water at a cheaper rate. This appears to have been the latest employment of animal power for the purpose.

"The New River, the greatest and most splendid work that was ever undertaken for the supply of a modern city with water, was commenced in James the First's reign. In 1605, the 3rd of James the First, the supply of water was found to be inadequate to the wants of an increased population; and as at that time the discovery of the steam-engine had not been made, it was necessary to seek abroad for more powerful springs of water than had hitherto been discovered, and at a sufficient elevation to allow the water to run to London; these were met with in the neighbourhood of Hertford, above twenty miles north of London, and the citizens conceived the vast plan of bringing these springs by means of a channel to Islington, and for that purpose obtained an Act of Parliament, empowering them to bring a stream of water from the springs of Chadwell and Amwell in the county of Hertford, between the towns of Hertford and Ware. By this Act, 3rd of James the First, they were empowered to make a 'trench, channel, cut, or river;' the width of the ground to be purchased being limited to 10 feet; and as these springs were situated in the valley of the river Lee, and, consequently, ran into the said river, they were bound to compensate, not only the owners of property through whose lands the new river was to be carried, but also 'all such persons as shall sustain any damage, loss, or hindrance, in their mills standing upon any of the rivers or streams from

which the water shall be taken through the said new cut, or river.' That this was a proviso of great consequence may be supposed, when at the present day it is stated that one of the springs yields a quantity of water equal to about 3,770 imperial gallons per minute, or 54 millions of barrels per annum.

" Surveyors were employed by the city to plan the execution of the work; but it was discovered that, as the Act limited the width of the property to be purchased to 10 feet, it would be impossible to convey the waters across the hills and valleys to London: the city therefore applied to Parliament again the following year for power to make tunnels, where necessary, either to be laid in the earth or formed upon arches, and an Act was passed accordingly in the 4th of James the First. Even with these additional powers the proposed course of the river was extremely circuitous; and the work was not completed until some years after.

" In 1608, Sir Hugh Myddleton, citizen and goldsmith, offered at his own charge to carry the Acts of James into execution; and to this great and enterprising man were the inhabitants of the Metropolis indebted for one of the greatest blessings that could be conferred upon any city. In 1610, the citizens, by an Act of Common Council, made over their powers to Sir Hugh Myddleton; and in 1612 this Act was confirmed by an indenture. The work, however, appears to have been commenced in 1608, and was completed in 1613.

" It was opened and the water admitted into the basins at the New River Head at Michaelmas, 1613, with great pomp, on the day that Sir Thomas Myddleton, brother to Hugh, was elected Lord Mayor. In 1619 a charter of incorporation was granted by James I. to Sir Hugh Myddleton, citizen and goldsmith, in conjunction with other wealthy citizens, and they were styled 'the Governor and Company of the New River brought from Chadwell and Amwell to London." It empowered them to improve the river, to prevent nuisances being committed therein, *under penalty of the king's displeasure,* subject to the laws for the contemners of the king's authority; and, *under the same penalty*, all other parties were prohibited bringing water for the supply of the Cities of London and Westminster, and the Borough of Southwark, without a licence from the Governor and Company of the New River.

" The king subscribed towards the undertaking, and was thereby entitled to a moiety of the profits. The work was said to have cost 500,000*l.*: the capital was divided into 72 shares, of which the king had 36; but so poorly did the scheme answer at first, from ignorance of the great advantages that the Metropolis would derive from this splendid work, that Sir Hugh Myddleton, who had spent the whole of his fortune, was ruined, and the proprietors did not for 30 years divide more than 5*l.* per share, or about 1*s.* 6*d.* per cent. The king, who was entitled to a moiety, also alienated his share, reserving only 500*l.* per annum out of it. Although the king's share is now in private hands, the holders of it take no part in conducting the affairs of the Company.

" It should here be added that previous to the year 1738, the supply from the springs was found to be insufficient, and arrangements were made with the trustees of the river Lee, to enable the New River Com-

pany to divert water from the said river. This was done, first by pipes, and afterwards by a cut and trough into the New River, the dimensions of which were determined by Act of Parliament, passed in 1738, in the 12th year of the reign of George the Second."

A property is still retained by the Corporation in some of the old sources of supply to the city, and others were made over to meet the interest upon its debt to the Orphans' Fund. The city aqueducts are at Paddington, Hampstead, and Marylebone. The Paddington spring has been sold to the Bishop of London, but the stock in which the purchase money was invested has been carried to the Orphans' Fund account. The other springs are leased for 21 years; the produce of the whole being 312*l.* 12*s.* 2*d.* per annum.* The Hampstead springs still supply some northern suburbs, under the management of a company which has its office at 43, Frederick-place, Hampstead-road: they are the most ancient of the existing works.

In this farming out of their functions by the Corporation of London to enterprising individuals, we see the commencement of the existing system of works for the supply of water. Such leases of power were not in those days restricted to public works, but extended even to the administration of justice. Derelictions of duty in this latter form do not now, however, disgrace the city. But the system of abandoning that part of the public works of the Metropolis which we have now under consideration to the close calculations of private enterprise, with all its prudential dispositions and interests antagonist to the consumer, virtually unchecked by any public authority, has not only continued to the present day, but grown with the growth of the Metropolis, under the sanction of Parliament, out of the city, as under that of the Common Council within its walls. It took some time, however, to eradicate from the city conscience the principle that the municipality was responsible for the proper supply of the inhabitants. In 1654, the Court of Common Council passed an Act for levying on the inhabitants of the city two-fifteenths for sundry repairs of conduits, and for the employment of the poor in bringing water into the city; each fifteenth to be equal to 500*l.*, and to be raised from the different wards in the proportions assigned. In 1681, four-fifteenths were raised for the like purposes.

The old works at London Bridge, too, were still in active rivalry with the New River; and in 1701, having been purchased from the family of the original lessee under the Corporation for 35,000*l.* by one Richard Soams, citizen and goldsmith, he procured, to secure his property in the whole, a lease of the fourth arch for 381 years; the third arch being in possession of a wharfinger. Soams formed a company by 300 shares of 500*l.* each; and to this company, in 1761, a further lease was granted of the third arch for 321 years; and, in 1767, another of the fifth arch from the north end, and the second arch from the south end (the latter to be used for the supply of the borough), for 315 years,—so that all the leases would expire simultaneously in the year 2082, being 500 years from the time when the original grant was made for that term. But this contemplated length of days was cut short in 1822 by the statute of the 3rd of Geo. IV., c. cix., local and personal, which provided for the entire removal of the London Bridge water-works, with a view to the improvement of the old bridge, or the erection of a new one,

* Report of the Corporation Commissioners, p. 216.

and transferred the service of their district to the New River Company. It was, however, made a condition by the latter, in accepting it, that they should have a steam-engine to pump from the Thames in case of failure in the supply by the New River through frost or drought; and a 100-horse engine was accordingly erected at Broken Wharf. At the time of this suppression of the London Bridge works, as a nuisance to the navigation, the number of water-renters was 10,417, and the quantity of water raised annually 39,484,000 barrels, or 2,704 gallons per minute, being twelve times greater than that first raised in 1582 by Peter Maurice.

The existence of large districts of the Metropolis without the city and borough, dates only from the period of this first employment of inanimate power; and companies, with powers to take up the public streets, &c., have been successively sanctioned by the Legislature, as the wants of such districts offered promise of profit to the speculator in their supply. One of the oldest establishments was the "Merchant Water-works," to which belonged three engines for raising water; one a windmill in Tottenham Court fields, and two over-shot water-wheels, worked by the water of a common sewer in St. Martin's and Hartshorn lanes, in the Strand. From these works there were three mains of 6 and 7 inch bores to supply the respective neighbourhoods.

The Shadwell works, erected about 1660, had first a horse-wheel, and afterwards two atmospheric engines, which supplied the neighbourhood with Thames water through two mains of 6 or 7 inch bores. In 1691 these works, which had previously belonged to the family of Thomas Neale, Esq., were vested in a Company of Proprietors, who were incorporated by an Act of Parliament 3rd and 4th of William and Mary. Two engines of Bolton and Watt's manufacture were afterwards erected; the first being one of the earliest engines made by them. When the London Docks were made, the district of their supply was much reduced, and the works were purchased by the Dock Company. Afterwards an Act was obtained, in 1808, by the East London Water-works Company, to enable them to purchase these works, which were eventually given up, the supply from the Company's new works being superior.

The York Buildings Water-works, in Villiers-street, Strand, were established in 1691. The Thames water was raised for the supply of the neighbourhood, first, by a horse-wheel—previous to the year 1710 they had one of Savery's engines, and a few years afterwards one of Newcomen's. Maitland says, in his work published 1756, that "the directors of this Company, by purchasing estates in England and Scotland, erecting new works, and other pernicious projects, have almost ruined the company. However, their chargeable engine for raising water by fire being laid aside, they continue to work that of horses, which may, in time, restore the company's affairs." This was true for a time, as it appears that, from 1789 to 1804, this Company paid good dividends; but in consequence of the ruinous competition which arose at the latter period, and continued for some years, an engine was erected of 70 horses' power, iron-pipes were laid down instead of wooden ones; no more dividends were paid, excepting 1*l.* per share for two years, out of the *capital*; and, in 1818, the company was ruined, the establishment broken up, and the district supplied by the New River.

The Chelsea Water-works were established in 1722, by an Act of

Parliament in the 8th of George I., for better supplying the city and liberties of Westminster, and parts adjacent, with water. The Thames water was raised from settling ponds, in the first instance by a water-wheel, which was worked by the water collected in large ponds as the tide rose, and kept in until the water in the river lowered, when it was let out and worked the wheel—afterwards, two of Newcomen's engines were erected, and, in 1782, one of Bolton and Watt's engines, being one of the earliest erected in London.

The West Ham Water-works were set on foot in 1743, and a Company was established by Act of Parliament, the 21st of George II., in 1747. The water was raised out of one of the branches of the river Lee, by a fire-engine of about 6 horses' power. These works were afterwards purchased by the East London Water-works Company, at the same time that they purchased the Shadwell works, and the force now used is a water-wheel of about 16 horses' power.

Previous to the year 1756 there was a horse-machine for raising Thames water through a 7-inch pipe in Southwark, called the Bank End Water-works. A company was formed in 1758, under the name of the Old Borough Water-works Company, which, together with the London Bridge works, supplied Southwark. A steam-engine was erected afterwards; and in 1823, upon the removal of the London Bridge water-wheels, the two works were consolidated under the name of the Southwark Works, and became the property of John Edwards, Esq.

Previous to 1756 works were established at Rotherhithe. The water was raised by a water-wheel, which was worked by tide-water collected in the ditches and ponds in the neighbourhood, and kept until the falling of the tide, when it was let out again into the river, and, in its course, turned the water-wheel. It supplied the neighbourhood plentifully through two 6-inch mains.

Previous to the year 1767 works were established at Lea Bridge upon the river Lea, worked by a water-wheel, for the supply of Hackney and Clapton. They were called the Hackney Water-works, and, in 1829, they became the property of the East London Water-works Company.

In 1785 the Lambeth Water-works were established by Act of Parliament, 25th George III., to supply the district upon the south side of the Thames, exclusive of the parishes of St. George and St. Saviour, Southwark; and in 1805 the South London Water-works were established by Act of Parliament, 45th George III., to supply the district on the south side of the Thames not already supplied by the Lambeth and Southwark works.

Down to this period the gradual progress of the supplies had given occasion for no great struggle; but the introduction of several new companies with large capitals early in the present century put to the severest test the principle of competition in the discharge of the great municipal duty of supplying the Metropolis with water; and after the streets had been torn up in the contest so as to become nearly impassable, and vast sums had been utterly wasted in competing lines of pipes in the same districts and streets, this principle was proved to be utterly inapplicable to the circumstances; and at length it was discovered that, without municipal powers of regulation, there was no medium between an unlimited sacrifice of capital on the part of the competing companies, or their combination to partition the town into monopoly districts, out of

which they could indemnify themselves for past losses, and obtain a future ample revenue, by charging their own rates for supply. The struggle among the companies at this period is very vigorously described in the Report of the Commons' Committee on the Supply of Water to the Metropolis, in 1821.

The London Bridge, the New River, and the Chelsea Water-works, with three smaller establishments, no longer in existence, states that Report, " had the whole supply of the Metropolis north of the Thames, previously to the year 1810. None of them had any legal privilege in the nature of a monopoly, but each possessed a monopoly in effect, through the greater part of the district which it supplied. Where their works intermixed, as they often did, it was the effect of a very gradual extension; and though the inhabitants of those parts of the town had the benefit of a choice, no mischievous spirit of rivalry seems to have been excited between the companies.

" The East London, West Middlesex, and Grand Junction Companies, were formed under the several Acts of Parliament, noted in the margin; they began to supply the town about the year 1811.* The principle of the Acts under which these companies were instituted, was to encourage competition; and certainly in this, as in other cases, it is only from competition, or the expectation of competition, that a perfect security can be had for good supply; but your Committee are satisfied that from the peculiar nature of these undertakings, the principle of competition requires to be guarded by particular checks and limits in its application to them, in order to render it effectual without the risk of destruction to the competing parties, and thereby ultimately of a serious injury to the public.

" Competition, in ordinary cases, adjusts the supply to the demand through the liberty which the sellers have to go out of the market as well as to come into it; but in trades carried on by means of large capitals, vested in fixed machinery, and furnishing a commodity of no value but for consumption on the spot, the sellers are confined to the market by the nature of the trade; and if the new comer has to seek immediate employment for large works, by taking custom from the established dealer, as there can be no great difference in the quality of what they sell, they must vie in lowness of price, and will probably be driven to underbid each other down to the point of ruin, because it is better to take anything than to take nothing for that which cannot be carried away; and this must go on until both are worn out, or one has outlasted the others, and succeeded to a real and effective monopoly, or until by some arrangement between themselves, they can put a stop to their mutual destruction.

" These consequences appear to have followed from the late protracted competition between the water companies; it was carried on during several years at a very ruinous loss, and must, in all probability, have led to the extinction of all except one or two of the wealthiest, as it actually did to that of the smaller companies, but for an arrangement which finally took place, and by which the supply of the town was partitioned between them, each company withdrawing its services within a line agreed upon, and exchanging with the other the pipes beyond its own boundary.

* East London, 47 Geo. III.; West Middlesex, 46 Geo. III., 50 Geo. III., 53 Geo. III.; Grand Junction, 51 Geo. III., 56 Geo. III.

"This arrangement was effected between the New River and East London Companies, about the end of 1815; and between the New River, Chelsea, West Middlesex, and Grand Junction, at the end of 1817. In the former case a deed was entered into by the two companies, binding them by penalties to abstain from serving beyond the line drawn between them. In the latter, the four companies entered into no engagement to that effect, but left it to the prudence of each whether they would at any future time embark at the expense of fresh capital in a renewal of the contest. This difference of proceeding appears to have been occasioned by the wording of the West Middlesex and Grand Junction Acts, which rendered it doubtful whether those companies could bind themselves by engagement with any others to abstain from serving within certain limits.

"These measures, so questionable at the first view, and carrying with them so much appearance of a combination against the public, do nevertheless appear to your Committee to have been measures of self-preservation, leaving the companies only responsible for the use which they might thereafter make of them; they were, however, in themselves of a nature to excite, and did excite, a great degree of alarm and discontent; it was obvious that they placed the companies and the public in a relation, the reverse of that in which Parliament had designed to place them, and that, in rescuing themselves from ruin, they had, in point of fact, (however unavoidably) acquired a power which they might abuse to any extent. Some vexatious proceedings on the part of the West Middlesex and Grand Junction Companies, in matters of no great moment in themselves, but calculated to show what might be the consequences of a power without appeal, appear to have added to the irritation of the inhabitants of the districts served by them, and it was in this disposition of the public that the East London, West Middlesex, Grand Junction, and Chelsea Companies gave a notice, which they have since acted upon, that an increase of water rents would shortly take place, the amount of which was, generally speaking, about 25 per cent. above the old rates for the ordinary service. The two latter companies also gave notice, that they should make an additional charge for high or extra service, which does not appear to have been their practice in all cases before the partition. The New River Company, about two years after effecting their undertaking with the East London, raised their rents, which had been depressed during the contest with that company, to the old rate, but they have taken no measure of that sort subsequently to the partition of the western parts of the town. An expectation having since been constantly entertained, that the question would in some shape come before Parliament, it has been stated to your Committee, that they preferred waiting the decision of Parliament on the subject; taking it for granted that no prejudice would thereby arise to their claims.

"However capable it might be of precise proof that the increase thus demanded was reasonable (a point which your Committee have not felt themselves qualified to decide with the object of permanently sanctioning that specific increase), yet it is no wonder that, under the circumstances above stated, the demand was ill received, and its reasonableness very strongly disputed, more especially after the rash and unqualified pledges of the West Middlesex and Grand Junction Companies, circulated during the competition, that they could and would supply their respective dis-

tricts at the rates of 1810, or even at lower rates, including the advantages of high services, and of a more abundant and certain supply for ordinary service.

"Your Committee feel it their duty to state, that the old companies (the New River and Chelsea), are not involved in this charge of culpable precipitancy, if not of intentional delusion."

"Your Committee are clearly of opinion, that in availing themselves of their present situation to increase their rents, the companies owe to the public a complete exposition of the grounds on which they proceed; and that if those grounds are just, such an exposition cannot but be advantageous to themselves.

"But more than all, your Committee are desirous, that, for the sake of a final good understanding between the public, and bodies of men whose property is most usefully employed in its service, the question of the quantum of charge should be disengaged from other questions with which it is at present mixed, and which tend to produce dispositions unfavourable to a candid and liberal consideration of it.

"The public is at present without any protection, even against a further indefinite extension of charge. In cases of dispute, there is no tribunal but the boards of the companies themselves to which individuals can appeal: there are no regulations but such as the companies may have voluntarily imposed upon themselves, and may therefore at any time revoke, for the continuance of the supply in its present state, or for defining the cases in which it may be withdrawn from the householder. All these points, and others of the same nature, indispensably require legislative regulation, where the subject-matter is an article of the first necessity, and the supply has, from peculiar circumstances, got into such a course, that it is not under the operation of those principles which govern supply and demand in other cases; and your Committee are of opinion, that as it cannot be precisely foreseen how the rules which they are prepared to suggest for these purposes may work, it would be expedient that they should be enacted, in the first instance, only for a short period."

"Your Committee therefore take the liberty to recommend that a Bill should be introduced and limited to four years, restraining the companies from advancing the rates beyond the proportion of 25 per cent. on the old rates, for what is termed the ordinary service of water for domestic purposes; leaving high and extra services as matters of agreement between the parties, but defining the one and the other, and establishing, as far as may be found practicable, fixed rules for the rates of charge on trades consuming large quantities of water."

This proposal to get out of the difficulty by establishing a minimum price, which was never carried into effect, is simply a clear recognition of the false position in which the public has been placed by the universal surrender of the supply of water into private hands, of which the corporation of London set the example. Suggestions were also hazarded for the appointment of umpires, to settle cases of disputed fairness of rating; but there is still no appeal from the decision of the several companies. In fact, the water companies are in the full enjoyment of the wide margin of profit between that bare remuneration for their outlay, which would have been taken by a municipal body, and that excessive exaction in proportion to the supply, which alone will ever provoke the whole public to an appeal to Parliament against the existing system,

which neither interest nor responsibility calls upon its administrators to improve to the extent, which, with such enormous revenues, an efficient public trust would soon find practicable. "The only remark which we shall venture to make on this subject," state the Commissioners who investigated the quality of the water supplied by the several companies in 1818, "is one naturally suggested by the evidence which has come before us in the course of our inquiries, viz., that if, on the one hand, the preservation of the present water companies, from which the public have undoubtedly derived immense benefits, would be endangered by unlimited competition with new companies that might be established with similar objects, it must, on the other hand, be evident, when due regard is had to the consideration that the constant and abundant supply of pure water is an object of vital and paramount importance to the inhabitants of this vast metropolis, that the dispensing of such a necessary of life ought not to be altogether left to the unlimited discretion of companies possessing an exclusive monopoly of that commodity; and that the interests of the public require that while they continue to enjoy that monopoly, their proceedings should be subjected to some effective superintendence and control."* And at this very period (in 1828), the companies on the north side of the Thames had advanced their yearly revenue 44,000*l.* beyond what the Committee of 1821 had found them taking and had considered to afford them an ample profit.†

The Commissioners, whose words we have here quoted, were appointed in consequence of addresses to the Crown from both Houses of Parliament, on account of the alarm which had sprung up in 1837, in regard to the quality of the water supplied to the Metropolis; occasioning the presentation of various petitions to Parliament. The Commission was directed to Dr. P. M. Roget, Mr. W. T. Brande, and Mr. Thomas Telford; and in a brief and dispassionate report, they described the real defects in the existing supplies, divested of all exaggeration. Their report at once calmed the excitement which prevailed, and compelled the water companies to engage in extensive plans of improvement, in regard to settling reservoirs and filtration. In 1831, however, another Commission was addressed to Mr. Telford, requiring him to report upon the means of supplying the Metropolis with pure water. In February, 1834, this gentleman presented his report, recommending the construction of covered aqueducts, to convey the water of the Verulam above Watford to Primrose-hill, to be distributed by the service pipes of the three companies supplying the western parts of the Metropolis, on the north side of the Thames; and those of the Wandle at Beddington, to Clapham-common, to be distributed in like manner by the service pipes of the three companies on the south side of the river; at the same time pointing out advisable amendments in the supplies obtained by the New River and East London Companies. This report, notwithstanding that it was followed up by the labours of a Committee of the House of Commons in the same year, did not lead to the adoption of any practical measures; the alarm on the subject of the Thames water, which had previously agitated the public, having greatly subsided, while the rude estimate for the proposed works was no less than 1,177,840*l.* It was

* Report of Dr. Royd, Professor Brande, and Mr. Telford; Sess. 1828, No. 267, p. 12.

† Commons' Committee's Report, Sess. 1828, No. 567, p. 5.

even urged against these plans, that the proposed covered culverts would gradually become obstructed with a vegetable growth, the increase and corruption of which would deteriorate the water, and cause interruptions in its supply for the purpose of cleansing the channel, unless the enormous expense of a double culvert were incurred. Supported by this view, and by a number of curious observations made with great accuracy upon the springs which supply the deep wells sunk, completely through the London clay, to the gravels and chalks beneath it, an endeavour was made, in 1834-5, to form a "Metropolis Pure Soft Spring Water Company," to supply the existing companies with their requisite quantities by Artesian wells of great magnitude, which appears to have failed, rather through defects in the provisional committee, than through any demonstrated impracticability in their views, which had been entertained ten years previously, and formed the subject of an unsuccessful company in 1825. At present, however, there is abundant evidence against a reliance upon the quantity derivable from the deep wells. Some portions of Mr. Telford's plan for supplying the northern parts of the Metropolis, combined with this for obtaining supplies from the deep springs, were submitted to the Legislature in a Committee of the House of Lords in 1840, but received no public sanction. On this occasion, the water companies generally refused to supply the statistics required by the Lords' Committee; and the description of themselves, given by the several companies to the Commons' Committee of 1834, will therefore give the best idea of the present means and methods of supplying London with water.

The principal Acts of Parliament relating to the *New River Company* (whose offices are at the New River Head, near Sadler's Wells), since the date of its charter, in the 17th of James I., are, one of the 12th of George II., having for its general object the improvement of the navigation of the river Lea, but which recites, *inter alia*, that the New River Company had for many years then past received a considerable supply of water from the river Lea, and that disputes had arisen between the corporation of Hertford, the inhabitants of Ware, and the New River Company, in relation to which it contains several provisions for ascertaining and rendering constant the supply from the river Lea; and another of the 3d of George IV., which settles the terms of agreement between the Corporation, the London Bridge Water-works Company, and the New River Company, for the transfer to the latter of the interest and implements of the Bridge Company, and their permission to pump water out of the Thames by an engine at Broken Wharf, Thames-street, the use of which is, however, confined to cases of extreme drought and temporary obstruction by frost, cutting off the ordinary supplies by the New River.

About two-thirds of the waters of the New River are supplied by the spring at Chadwell, and one-third by a neighbouring inlet from a branch of the river Lea; and to convey the whole to London, a distance of about 21 miles, there is an artificial channel nearly 40 miles in length, winding at the foot of the hills which border the valley of the Lea on the west. This delivers the united waters into four reservoirs, called the New River Head, at Clerkenwell, 84 feet above the level of the Thames; proper means being adopted to prevent the ingress of fish and weeds; and such arrangements being made in the mains as to prevent

interruption to the supply in case of repairs. The greater part of the service is delivered from this Head without pumping; but there are two engines at the Head which could raise for a high supply 8,820,000 gallons per day, and which, in 1833, raised on an average 2,100,932 imperial gallons per diem into Claremont-square and the reservoir in the Hampstead-road, to a height of 60 feet above the Head, making a total height of 144 feet above the level of the Thames. The company are not able to state the capital originally invested in the aqueduct and lands purchased for the use of the works; all documents relating to the greater portion having been lost by lapse of time, or destroyed by a fire in 1769; but the works were valued, in 1828, at 600,000*l* : in addition to which 438,725*l*. had been expended in steam-engines, water-wheels, pipes, and other machinery; and down to the close of 1833, 78,239*l*. more was thus expended: making a total supposed expenditure of 1,116,964*l*., or 15,512*l*. on each of the 72 shares into which this vast property is divided; a sum, however, entirely suppositious, chiefly extracted from the water-rents themselves, and, in all probability, vastly exceeding any actual outlay from capital paid up by the shareholders at any period of the company's existence; the estimated expenditure of 500,000*l*. already mentioned being apparently without authority.

The water-rents for houses and buildings amounted in 1833 to 96,245*l*. 10*s*.; for watering streets, to 2,062*l*. 12*s*. 4*d*.; making a total of 98,308*l*. 2*s*. 4*d*.; while the rents received for lands and houses amounted to 6,601*l*. 4*s*., raising the total income to 104,909*l*. 6*s*. 4*d*. The expenditure in the same year amounted to 61,163*l*. 1*s*. 3*d*., leaving a net profit of 43,746*l*. 4*s*. 11*d*.; but the ordinary annual expenditure was estimated only at 38,000*l*., which would leave for this year a net profit of 66,909*l*. 6*s*. 4*d*. The house water rental was derived from the supply of 70,145 houses and buildings, of which 3,067 paid 50 per cent. extra for high service; the general average being 26*s*. 6*d*. per house or building. The total quantity of water supplied yearly was then estimated at 114,650,000 hogsheads, at an average charge, computed on the gross water rental, of 17*s*. 1¾*d*. per 1,000 hogsheads, and affording an average daily supply to each house or building, including manufactories, of 241 gallons. About seven-eighths of the whole is supplied direct from the Head, at an elevation of 84 feet, and the remaining eighth at the higher pressure of 144 feet. The dividend in 1770 was 255*l*. per share; in 1810, 465*l*.; and in 1833, 617*l*; but between the latter periods the advance has been in part derived from the augmented value of the old landed property of the company. The first instance on record of an increase in the rates of supply was in 1804 and 1805, when they were raised about 20 per cent. About the year 1811, on the introduction of the new water companies, the rates began to be depressed; and the depression went yet further until some time in the year 1817, when it was stopped by the arrangement which took place among the companies. It was not, however, until 1823 that the new company restored their rates to the amount at which they stood in 1810, the year before the contest; and they then laid down a distinct scale of price (50 per cent. advance) for high service, which had never been furnished before the introduction of iron pipes, and, consequently, had no analogy in the rates of 1810.

The deficient supply of water by the New River Company to the city

was made a subject of complaint in the Common Council, in 1836, and it was referred to the City Lands Committee to examine into the circumstances. Rather than resort to supplies in aid from the Thames, the company had, in many instances, discontinued the supply from the main, to the great inconvenience of the many persons who were unprepared with cisterns, or had none of sufficient size to meet such a change of system. On many occasions of fire, too, it was shown that the supply, for want of regulation to procure the attendance of the turncocks, had been insufficient for the due security of the vast interests concerned. But the officers of the company professing their readiness to satisfy every reasonable demand, their assurances were accepted. No other part of the town, however, has even this indirect means of influence over the companies or their officers.

The New River Company supplies all the Metropolis north of the Thames from Charing Cross, the Haymarket, Poland-street, the Tottenham Court-road, and the Hampstead-road on the west, to the Tower, Shoreditch, the Kingsland-road, and Dalston, on the east. "Where the New River commences at the Chadwell spring, the water is generally pure and transparent; but in passing through nearly 40 miles of a populous vicinity, without protection, it is unavoidably exposed to various impurities; the surface-water from the uplands, sewages from the villages, cattle treading down the edges of the river banks, all combining to produce discoloration of the water, which is still more increased by the operations necessary to restore the banks, and, near the metropolis, by numerous persons bathing and creating other nuisances.* In order to obtain an additional quantity of pure water, the company should be required to pump it from the river Lea, some miles below the Government powder works at Waltham Abbey; towards which purpose they have purchased Tottenham Mill and 30 acres of land adjacent, and constructed reservoirs to the extent of 30 acres adjoining the New River at Newington, and adjacent to the site of Tottenham mills; and there being also an old branch of the river Lea, not at present in use, it should be transferred to the New River Company, who thereupon should be required to embank and enlarge it, to not less than 20 acres, and convert it into a settling reservoir, upon which the pumping engines should be placed." †

The *East London Water-works Company*, established in the year 1807, under the provisions of the 47th of George III. c. 72, amended by the 48th of George III. c. 8, and extended by an Act of the 10th of George IV., have their establishment at Old Ford, on the river Lea, just above Bow bridge, and their office at 16, St. Helen's Place. Their engines can pump 11,293,776 gallons per day, or 79,681,875 hogsheads per annum. The capital is limited, according to Act of Parliament, to 500,000*l.*, in 5,000 shares of 100*l.* each; and the joint-stock capital created to the close of 1833 amounted to 443,333*l.*, upon which the net sum received was 436,139; being an average of 98*l.* 8*s.* per share. The total expenditure on the works had exceeded the amount received on subscriptions by 158,849*l.*, making the gross expenditure 594,988*l.*, including the moneys thus applied in lieu of being shared in dividends. The gross produce of the water rents in 1833 amounted to 53,061*l.* 10*s.*,

* The bathing is now more rigorously punished.

† Report of Thomas Telford, Esq., February 17, 1834, pp. 6, 7.

and the current annual expenses to 15,080*l.*, which would have left a net profit of 37,981*l.* 10*s.*, but for an extraordinary expenditure of 31,717*l.* 2*s.* 6*d.* The houses and buildings supplied were 46,421, without any extra charge for high service, such as had been introduced by the New River Company; and the average rate upon each house or building, including the large consumers, was 22*s.* 9*d.* The total quantity of water supplied yearly was then estimated at 37,810,594 hogsheads, at an average charge, computed on the gross water rental, of 28*s.* per 1,000 hogsheads, and affording an average daily supply to each house or building, including manufactories, of 120½ gallons per day, being only half the average supply in the New River district. The highest elevation at which the water is supplied is 107 feet, the mean elevation 60 During the competition with the New River Company, the dividends of the East London Company were only 2 per cent. per annum; but after its termination by agreement, they were raised to 5 per cent. per annum on the paid-up capital; the sum appropriated to their payment in 1833 being 22,166*l.* 13*s.* 4*d.* The average supply in this year was 5,593,896 gallons per day; the greatest 6,194,700 gallons, and the least 4,874,004 gallons.

The East London Water-works Company supply all those portions of the Metropolis, and its suburbs, which lie to the east of the city, Shoreditch, the Kingsland Road, and Dalston; extending their mains even across the river Lea into Essex, as far as West Ham. Formerly, the water supplied by this company was admitted into its settling reservoirs from the tide-way of the river Lea, at high water, and was therefore "the water of the river Lea subjected to the contamination of the district through which it passes in and below the neighbourhood of Bow, and to the constant agitation of the tides in driving upwards towards the water-works; thus rendering it no better, as far as regarded matter held in suspension, than the water of the Thames taken up in its passage through the Metropolis." "But after the Commissioners of Inquiry into the quantity and quality of water supplied to the Metropolis had made their report in 1828, the East London Water-works Company took immediate steps to improve their water, both in quantity and quality, by obtaining powers, under their last Act of Parliament, in 1829, to take water from the river Lea, at or near Lea Bridge Mills, above the influence of the tide, and to convey it from thence to the works at Old Ford, by means of a new aqueduct (insulated from all other) into settling reservoirs, upwards of 18 acres in extent, from which it passes into the reservoirs out of which the pumps are supplied." These works, which cost upwards of 60,000*l.*, Mr. Telford reported, in 1834, to have anticipated the improvements which he would have thought necessary for ensuring a better supply of pure water to the district dependent on them.

"The only point upon which any question might arise," states Mr. Telford's Report, "is rather of a prospective nature, inasmuch as it relates to the sewage of the district on the west side of the river Lea, between Tottenham Mills and Lea Bridge Mills, which sewage is now discharged into the Lea; but should a greater number of buildings, or a town, grow up on that side of the river, it would then be advisable to carry the sewage of that district clear of the portion of the river above named, either by conveying it under the river at one or more points, or by connecting it with the Hackney sewage, which goes into the tideway of the

river Lea, below Old Ford Lock. But this is a part of the subject which might, with propriety, come under the control of a general commission for the conservation of the water supplied to the Metropolis."*

The *Chelsea Water-works Company*, established for the supply of Westminster in 1703, under the 8th of Geo. I. c. 26, and possessed also of a charter of the 9th of Geo. I., a writ of privy seal of the 7th of Geo. II., and a second Act of the 49th of Geo. III. c. 157, have their engines on the banks of the Thames, about a quarter of a mile east of Chelsea Hospital, and a few hundred yards below the mouth of the Ranelagh sewer; their office, at 16, Great Queen Street, Westminster. Their supplies are derived entirely from the river, opposite to their works; and they have two reservoirs, one in Hyde Park, near Grosvenor Gate, and the other in the Green Park, close to Piccadilly. The greatest quantity which their engines, in 1834, were calculated to raise, was 4,640,000 gallons per day; and in the preceding year, 2,337,000 gallons was the average quantity pumped daily to a height of from 45 to 135 feet. The capital subscribed and invested is 70,000*l.*, of which 60,000*l.* was expended previously to 1735, and the remaining 10,000*l.* about 1829 (subsequent to the Report of the Commissioners), in constructing a filter bed and reservoir. The sums actually expended in the works, however, in reservoirs, cuts, water-wheels, pipes, and steam-engines, including all moneys invested out of the water rental, in lieu of being shared in dividends, amounted, in 1833, to no less than 271,311*l.* 3*s.* 9*d.* The shares are 2,000 of 20*l.* each; 2,000 of 10*l.* each; and 800 of 12*l.* 10*s.* each. The gross water rental amounted, in 1833, to 22,906*l.*, and the annual charge upon this sum to 13,481*l.*, besides about 4,500*l.* yearly expended in various necessary works and improvements; leaving a net profit of 4,925*l.*, of which 4,800*l.* was employed in a dividend, being at the rate of 14½ per cent. on the paid-up capital. The water rental was derived from 13,892 houses and buildings, supplied at an average rate, including the large consumers, of 33*s.* 6*d.* The total quantity of water supplied in the year was 15,753,000 hogsheads, at a charge, computed on the gross water rental, of 29*s.* per 1000 hogsheads; and affording an average daily supply to each house or building, including manufactories, of 168 gallons. The highest elevation at which the water is supplied is 135 feet; and the mean elevation, 85. High service was given to 1,927 houses, but no separate charge was made for it. An increase of 15 per cent. had, however, been made in the rates, since 1828, for filtration. The district supplied by the Chelsea Water-works, is the whole of Westminster, and the suburban parishes, south and west of Charing Cross, Pall Mall, St. James's-street, Piccadilly, Park-lane, and the Uxbridge-road; from which latter line, the western limit of the Chelsea supplies, sweeps round the western verge of Kensington Palace, along Kensington Gore, and thence, before reaching Knightsbridge, across to the Old Brompton-road, which it follows down to the Kensington Canal, and is then continued along the latter to the Thames.

The Grand Junction Water-works Company, 7, Brook-street, Grosvenor-square, commenced its works in 1810, although its first Act was not obtained until the following year, being the 51st of Geo. III. c. 169, afterwards amended by the 56th of Geo. III. c. 4, 1816, the 59th of Geo. III. c. 111, 1819, and the 7th of Geo. IV. c. 140, 1826. This

* Report of Thomas Telford, Esq., February 17, 1834, p. 8.

company, ceasing to draw from the Grand Junction Canal, fixed their engines contiguous to the grounds of Chelsea Hospital, between this building and the Chelsea Water-works, and precisely at the mouth of the great Ranelagh sewer; and from this spot they drew the whole of their supply; pumping it to three reservoirs at Paddington, from which their district is served. But after the report of the Commissioners in 1828, they adopted at once two measures of improvement; first, the extension of their suction pipe much further into the river; and secondly, the completion of a system of depuration by deposit, which they had already commenced at their reservoirs in Paddington. The public attack being, however, mainly directed, at the time, against this company, it was compelled to look out for entirely new sources of supply; and when it appeared that nothing would be done by Parliament on the report of Mr. Telford (during the preparation of which they had suspended their design for obtaining a supply from the river Colne), they applied to Parliament for power to take water from the Thames between Richmond and Kew; and after considerable discussion in the House of Lords, the site was fixed from which the company now draw their supply, viz., between 300 and 400 yards above Kew Bridge, on the Surrey side of the stream. To raise water from this spot, the Company have constructed new works near Kew Bridge, with an engine power of between 400 and 500 horses, by which, through a main near six miles in length, and 30 inches in diameter, the water is pumped to the company's reservoirs at Paddington, where works were forthwith undertaken for its filtration.

The capital of the company, as returned to the Commons' Committee of 1834, is limited to 300,000*l.*; but only 275,000*l.* of nominal stock has been created, in 5,500 shares, nominally of 50*l.* each, but upon which only 37*l.* 9*s.* 1*d.* was really paid; creating a net paid-up capital to the amount of 206,000*l.* In addition to this amount, however, 50,005*l.* 1*s.* 4*d.* was expended on works out of the revenue, the shareholders foregoing all dividend for 9 years; 27,000*l.* more was expended on them by the Grand Junction Canal Company, and 48,169*l.* 0*s.* 3*d.* by the Regent's Canal Company; making a total investment of 331,174*l.* 1*s.* 7*d.* The gross water rental, in 1833, was, 21,461*l.* 1*s.* 10*d.* from ordinary service; 4,017*l.* 8*s.* 4*d.* from high service; and 675*l.* 18*s.* 10*d.* from street watering; making a total of 26,154*l.* 9*s.*; while the estimated current expenditure, exclusive of a reserve fund, and the cost of filtration, was 11,000*l.* The dividend in the same year was 2*l.* 10*s.* per share, or about 7 per cent. on the paid-up capital. The number of houses and buildings supplied was only 8,780, the average charge for ordinary service being no less than 48*s.* 6*d.* The total quantity of water supplied was 21,702,567 hogsheads, at a charge, computed on the gross water rental, of 24*s.* 1*d.* per 1,000 hogsheads; and affording an average daily supply to each house or building, including manufactories, of 350 gallons, besides 13 gallons for street watering. The highest elevation at which the water is supplied, is 151 feet 9 inches; and the mean elevation, 100 feet. The average quantity raised per day was 3,744,213 gallons, of which two-thirds are pumped from 90 to 120 feet, and the remaining third 120 to 152 feet; the number of houses paying for high service being 2,360*l.* The district supplied by these works comprises the best parts of the metropolis, being the great square of town included by Oxford-street, Poland-street, and the Haymarket, St. James's Park, the

Green Park, and Hyde Park, together with the Park-square region, comprised between the Edgware-road and the Uxbridge-road, and extending northward to the Great Western Railroad, and even beyond it, so as to include the whole of Paddington, to the west of the former road, besides a considerable neighbourhood in the angle formed by the western end of Oxford-street, and the southern end of the Edgware-road.

The West Middlesex Water-works Company, established in 1806, by the 46th of George III., c. 119, subsequently amended by the 50th of George III., c. 132, and the 53d of George III., c. 36, have their engines on the banks of the Thames, at the upper end of Hammersmith, and their office at 20, Nottingham-place, New-road. They draw water exclusively from that river, opposite to the works, whence it is pumped to two reservoirs, one at Notting-hill, Kensington, and the other on Primrose-hill. On extreme occasions the engines could raise 6,000,000 gallons per day to an elevation of 122 feet. The capital is limited by statute to 400,000*l.*; but a nominal joint-stock capital has been created, to the amount of 830,000*l.* in 8,300 shares of 100*l.* each; but upon which only 378,466*l.* 6*s.* 9*d.* has been paid. For twelve years, the shareholders got no dividends; but counting this want of returns as so much additional capital advanced, they make the public repay them very handsomely. In 1834, they reckoned the gross expenditure on the works, including sums raised by their water rents as well as those from subscribed capital, at 404,263*l.* 2*s.* 6*d.* The gross water rental in 1833, was 45,500*l.*, including the charges for high services and trades, and the supplies to ornamental waters, public buildings, gardens, barracks, and for watering the streets, &c.; while the annual expenditure, exclusive of a reserve fund, was estimated only at 18,000*l.* The dividends are 3*l.* per share, or about 7 per cent. on the paid-up capital. The number of houses, buildings, and other places supplied was about 16,000, at an average charge of 52*s.* 10*d.* The total quantity of water supplied was 20,000,000 hogsheads, being 1,080,000,000 gallons, or 180,000,000 cubic feet, at a charge computed on the gross water rental, of 45*s.* 6*d.* per 1000 hogsheads, or about ½*d.* per hogshead, conveyed an average distance of five miles. The average daily supply to each service was 185 gallons; and the greatest total quantity delivered per day 3,800,000 gallons, or 73·8 cubic feet per second. The height of the Kensington reservoir is 122 feet; and that of the Primrose Hill reservoir 188 feet; the mean elevation at which the water is supplied being 155 feet. About 3,500 houses receive extra service. About three-fourths of the services are from the Kensington reservoir, at the lower level of 122 feet. The waters supplied by this Company, are undoubtedly the best derived from the Thames; and at the time of the agitation which caused the appointment of a Commission of Inquiry and the Commons' Committee of 1828, they took measures, by the purchase of the Barn Elms estate, on the side of the Thames opposite to their works, for forming settling reservoirs which would much improve it; a project which, however, was never carried out. The district supplied by the West Middlesex Water-works comprises all that portion of the town lying west of Tottenham Court-road, the London and Birmingham Railroad, and the Hampstead-road, and north of Oxford-street, the Edgware-road, and the Great Western Railroad, with the exception of the parts of Paddington, to the west of

the Edgware-road, and the neighbourhood in the angle formed by Oxford-street and the Edgware-road which is supplied by the Grand Junction Water-works. The West Middlesex Works also supply Bayswater, and the suburban parishes of Kensington, Fulham, Hammersmith, and Chiswick.

Thus the only portion of London exclusively supplied with Thames water is the best inhabited part (served by the Chelsea, Grand Junction, and West Middlesex Companies) which lies west of Charing Cross, Tottenham Court-road, and the Hampstead-road. Mr. Telford, however, reported, that "two miles above Watford, the valley of the river Verulam affords a commodious situation for extensive reservoirs of water, and for allowing it to settle, if such should hereafter be deemed requisite. From this place a covered aqueduct may be made to descend with a uniform inclination of 18 inches per mile to Primrose-hill, terminating in a set of extensive receiving and distributing reservoirs, at the height of 146 feet above high water in the river Thames. From these reservoirs, each of the three before-mentioned companies may be supplied separately, and in such proportion as shall be determined."*

The *Southwark Water-works*, which were, until recently, a private property (though now vested in a company), and were the first called into existence on the south side of the river, are situated between London and Southwark Bridges. Subsequently to the union with them of the district formerly supplied by the wheel at the south end of London Bridge, a large sum was spent in the construction of new works, including those situated in Battersea Fields. The whole, in 1833, were capable of supplying 3,300,000 gallons daily; but the average supply is only 1,100,000 gallons. The gross water rental, in 1833, was 7,850*l.*; the number of houses and buildings supplied, 7,100; and the average rate per house, 21*s.* 3*d.*, including manufactories, but only 15*s.* without them. The dividends in 1844 amounted, in the whole, to 6,400*l.* The total quantity supplied was 7,000,000 hogsheads, at an average charge of 21*s.* per 1000 hogsheads. The average daily supply to each house or building, including manufactories, was 156 gallons. The cisterns into which the water is pumped are generally 38 feet above high water in the river, and this may be regarded as the mean elevation; but the greatest elevation at which water is supplied is 60 feet. More than 1000 houses received high service, though only 45 were charged for it. The districts which these works chiefly supply comprises nearly the whole of the parishes of St. George and St. Saviour, Southwark (being the greater part of the borough), in which it was for many years virtually prohibited to the neighbouring company of the Lambeth Water-works to lay down rival pipes in any of the paved streets; but a recent active rivalry has rendered it impossible to define the limits of supply of any of the South London Companies.

The *Lambeth Water-works Company*, 139, Blackfriars-road, was incorporated by an Act passed in 1785 (25th George III., c. 89), entitled an Act for supplying the inhabitants of the parish of Lambeth and parts adjacent with water, and which restricted the company from laying down pipes for the conveyance of water in any of the then paved streets of the parishes of St. George and St. Saviour, Southwark, in the supposition that these were sufficiently supplied by the old works. This

* Report of Thomas Telford, Esq., February 17, 1834.

Act was amended by a recent statute of the 4th of William IV.; and the Act incorporating the South London Water-works Company protects the district of the Lambeth works, as those of the Southwark Company were protected against the latter. The Lambeth Water-works are upon the banks of the Thames, between Westminster and Waterloo Bridges. They draw the water from the river immediately opposite to them, and have no reservoir into which to raise it at once for settling and for supply. The engines are capable of pumping 9,293,000 gallons daily; but the average daily supply in 1833 was only 2,075,000, and the maximum 2,575,000. The capital is limited by statute to 226,000*l.*; but a nominal capital of only 96,000*l.* in 100*l.* shares was ever raised, and only 37*l.* 8*s.* 4*d.* was ever paid up on each of these shares, the net amount of subscription moneys received having been but 35,920*l.* The gross expenditure for engines, pipes, &c., amounted, in 1834, however, to 182,553*l.*; but the sum beyond the amount of subscriptions paid up, had been contributed by the public in rents. The gross water-rental amounted, in 1833, to 14,808*l.*, the current annual expenditure to 6,500*l.*, and the sum applied in payment of dividends to 3,840*l.* or nearly $10\frac{2}{3}$ per cent. on the paid-up capital of the subscribers. The number of houses and buildings supplied amounted to 16,682, at an average charge of 17*s.* The total quantity of water supplied was 11,998,600 hogsheads, at an average charge, computed on the gross water-rental, of 24*s.* 8*d.* per 1,000 hogsheads, and in the proportion of 124 gallons daily for each house or building, including manufactories. The highest elevation at which the water is supplied is 185 feet; but the mean is only 55 feet above high water in the Thames. The recent breach of all understanding among the South London Companies has rendered this Company's present limits of supply also very irregular and indefinite.

The *South London or Vauxhall Water-works Company*, established by the 45th of George III., c. 119 (1805), have their establishment in Upper Kennington-lane, Vauxhall, with an engine on the river-side, at the foot of Vauxhall Bridge, and an iron tunnel into the bed of the Thames below low-water mark. The whole supply of water being derived from the Thames, they laid out large sums in constructing reservoirs and filter-banks, through which the water should pass in its course to the engine; and this is the only company on the south side of the Thames which supplies no waters that have not gone through some degree of purification in reservoirs. The engines of this company can pump 6,000,000 gallons per day, on occasion; but the average supply does not amount to one-fourth of this quantity. The capital is limited by Act of Parliament to 160,000*l.*; but the nominal joint-stock capital which has been raised is only 100,000*l.*, of which 98,000*l.* have been paid up, being 98*l.* upon each of 1,000 shares of 100*l.* each. The gross expenditure upon the works amounted, in 1834, to 245,306*l.* 13*s.* 10*d.* being 147,306*l.* 13*s.* 10*d.* more than the capital paid up, which sum was applied from the rents. The gross water-rental amounted, in 1833, to about 9,000*l.*, and the current expenditure to about 4,000*l.*, leaving a net income of 5,000*l.* per annum. The number of houses and buildings supplied was 12,046, at an average rate of 15*s.* per house, including, manufactories. About 1830 the yearly supply was calculated at 300,000,000 of gallons; and, in 1833, the daily supply was supposed to average about 100 gallons to each tenant, or 1,200,000 gallons

daily, but the Company do not retain the means of exact statement. The highest elevation at which water is supplied is 80 feet, but the mean is unknown.

The recent history of the supply of water to the parts of the metropolis included in the county of Surrey is thus summed up in a memorial from the Southwark and Vauxhall Water Companies to the Health of Towns Commissioners, dated 10th January, 1845, on the eve of an application to Parliament for their amalgamation:—

"The companies by which that portion of the metropolis is supplied (the Southwark, the Vauxhall, and the Lambeth Water Companies) were, from the periods of their being respectively established, and prior to 1834, in possession of charters which more or less permitted or encouraged competition; but in that year, having all had occasion to apply to the Legislature for further powers to raise capital, certain restrictions, which tended in some cases to preserve the several companies' districts *free from the operations of the others*, were removed; and from that period a competition, in which sometimes two, sometimes all three companies, were engaged, has ensued, which was in full activity during the years 1839, 1840, and 1841, and which has only completely ceased since 1842.

"The results of that competition were as inconvenient to the public as they were disastrous to the companies, and afforded the very strongest illustration of the truth of the doctrine laid down by the Committee of the House of Commons in 1819, that the principle of competition cannot with advantage be applied to the operations of water companies.

"As regards the companies, the result of the struggle was an immense expenditure of capital in utter waste—double or treble sets of mains and pipes being laid down in districts where one set would better have served the inhabitants. An enormous annual outlay, equally in utter waste,—in the salaries of canvassers and commission to agents, who procured tenants; in the bills of plumbers, who changed the service-pipes of the tenants from one set of mains to another; in the charges of taking up and relaying roads and pavements on the like occasions; in double and treble sets of turncocks and pipe-layers; and, as the climax of absurdity, a payment of all parochial and district rates in every parish on all the pipes of all the companies, in proportion to the capital expended on assumed profits or interest, which it is needless to say had no existence. These expenses, being accompanied by a great reduction of rates, the result was such as might have been anticipated,—one of the companies, overwhelmed with difficulties and debt, ceased to pay dividends to its shareholders; the other two must shortly have arrived at the same condition; and the total return on more than half a million of capital expended has not since been, and is not now, more than $2\frac{3}{8}$*l.* per cent. per annum.

"The inconvenience as regards the public was scarcely less striking. The funds which should have been devoted to improving the supply of water were wasted; the districts which, being densely peopled, were supposed likely to yield a return, were encumbered with double and treble sets of pipes, and disturbed by the daily breaking up of the streets and roads, consequent on the incessant change of tenants from one company's mains to those of another, while other districts, less thickly inhabited, were left without the supply necessary for domestic conve-

nience or protection from fire. The impoverishment of the companies, arising from the double source of unnecessary expenditure and uncalled for reduction of rates, tended to incapacitate them from adequately discharging their duties to the public, and left them neither means, leisure, nor inclination for improving to the utmost the supply of water given to their tenants. Independently of the wasted capital in superfluous mains and pipes, the sum, as above stated, annually thrown away in plumbing, paving, and canvassing, was more than adequate to the depuration by deposit and filtration of the supply to all the tenants of the three companies. Neither was the sole end, which it might perhaps be supposed competition would answer, permanently attained. The prospect of impending ruin compelled a suspension of hostilities, and the rates of the whole district were raised to a level, which, though still very low as compared with the rest of London, are yet at least as high as would have obtained had there been no competition."

The Memorial then proceeds to call the attention of the Commissioners to an application to Parliament for a Bill for the establishment of a new company to supply the metropolis south of the Thames, as well as some portions of the town on the north of the Thames, with the waters of the Wandle, and observes that, under the present system of competition among companies in the discharge of this public duty, "the entire waste of the capital expended would be but the commencement of the evils which would be created by the execution of the proposed scheme. The competition recently terminated, would be renewed with augmented fierceness, as added capital would have to find remuneration from the same amount of tenants. * * * * This struggle would last probably for some years, attended of course by all its usual concomitants,—treble and quadruple sets of mains and pipes in every street, treble and quadruple officers and servants, treble and quadruple parish rates, and thousands annually spent in plumbers' bills and paving. The conflict would, of course, also have its usual termination. The companies would either agree to divide the whole district among them, or they would agree to a scale of rates. But there would then be an additional half million, on which interest must be paid (by the public in the shape of water-rates), and an additional establishment to be supported; burthens which an augmentation of from 50 to 100 per cent. of the present rates could scarcely suffice to support. That such would be the inevitable result of the establishment of the proposed company, the Directors are quite sure that the Commissioners are prepared, from the information already in their possession, confidently to anticipate."*

On the subject of a better supply of water to the southern parts of the metropolis, than that afforded by the existing companies, Mr. Telford reported, however, in favour of some such plan as that which the new company is proposing to carry out. "The best means of obtaining an ample supply of pure transparent water for the three Surrey companies is," he states, "by taking it from the river Wandle, at a sufficiently high elevation, which is found on the Croydon branch of that river, at the east end of Beddington Park, 90 feet above high water in the river Thames. From this place an aqueduct may be carried in nearly a direct line to Clapham

* Supplement to the Second Report of the Health of Towns Commissioners, p. 116-118.

Common, and there terminate in the requsite number of reservoirs, at a height of 82 feet above high water in the river Thames, which, except for Brixton Hill, supplied by the Lambeth company, exceeds the present heights of delivery by the several Companies."* At present, on the south side of the river, "there are three companies in some streets, and three sets of pipes; in others two; and we have, at present," states the engineer of the Southwark Water-works, "the exclusive supply of about one-tenth only of our district. On the average, there may be said to be two capitals in the same street. This is also the case with supplies of gas."†

"Companies are forced into arrangement with each other for their own safety, and the security of their investment; *which arrangement is always against the consumer*. Thus, in the case of St. John's Southwark: the Southwark Company had served the parish for many years, having pipes in every street. In 1841, the Vauxhall Company laid pipes in nearly every street in the parish, at an expense of 2,400*l*., and succeeded in procuring a water rental, by change of tenants from the Southwark Company, of 81*l*. For the time, the rates throughout the parish were reduced 25 per cent.; but in 1842, the competition ceased by arrangement, and the rates were raised to the same, or a *somewhat higher level* than they were before the competition commenced, though they are still much below the parliamentary scale of rates. * * * * To resume all the privileges granted, and to buy up the whole works on terms of compensation to the paid officers and shareholders, and to commence *de novo* under one authority, though not the only, would undoubtedly be the most practical course. The public would gain much, and would be enabled to compensate all interested parties liberally. Everything might then go on easily, without the obstructions of making bargains and settling conflicts at every step, or attending to any other than the public interest."‡

In addition to the great works now described, there are the *Old Hampstead Water-works*, which supply a large portion of Kentish and Camden Towns, and the *Kent Water-works*, situated upon the river Ravensbourne, at Deptford, the machinery employed by which consists of a water-wheel and two steam-engines. The water from this river is supplied chiefly to Deptford, Greenwich, Woolwich, and Rotherhithe. These works, being scarcely considered metropolitan, did not make returns with the others in 1834. At *Paddington*, too, there are some springs, belonging to the Bishop of London's estate, which supply the immediate neighbourhood.

The table on pages 172–3 presents a view of the present supply of water to the metropolis, to which I would now call attention. If, to supply its deficiencies, we reckon the supplies by the Kent and Hampstead works at only one-twentieth of the supplies by the whole of the other companies, and suppose their statistics to be of a character not very different from that presented by the averages of the latter, it would appear from this table that the amount of private capital *bonâ-fide* invested in the supply of London with water is about 1,810,750*l*.; and the total expenditure on

* Report dated February 17, 1834, p. 4.

† Mr. Joseph Quick, before the Health of Towns Commissioners, March 28, 1844, 5948.

‡ Ibid, 4950–54.

the works (including that out of the rates, charged to the public as private capital because not employed in dividends) 3,303,887*l.*, which approaches to double the amount of paid-up capital, an enormous municipal debt upon the public, to the further reckless augmentation of which there is no legal or administrative limit. The average of the dividends of the several companies claiming this amount from the public is 3½ per cent., but it is 8⅛ per cent. on their paid-up capital only; and the difference between these rates will represent, with some approach to accuracy, the probable amount of actual waste in rival machinery and materials and in monopoly dividends, the burden of which is devolved upon the public in the shape of an annual water-rental, which amounted, in 1833, to about 291,500*l.*, and, in 1845, would amount to about 340,000*l.*, reckoning merely by the increase of the metropolis, and upwards of 380,000*l.* reckoning by the augmentation of the demand, if the price per quantity remains the same, and the rate of increase experienced by the East London Company be general. The price at which the companies made their supplies in 1833, on the average, was 26*s.* 10½*d.* per thousand hogsheads, and 29*s.* 8*d.* per house; the average of the mean quantities delivered by these several companies to each house or building being 180½ gallons per day, and the average of the mean heights at which they delivered it 79¼ feet.

The yearly supply in 1833 appears to have been about 247,710,500 hogsheads, and is now probably about 330,000,000 of hogsheads, or nearly 905,000 hogsheads or 10,140,500 cubic feet, per day; being collectively a lake of upwards of 77 acres, 3 feet deep, distributed among a population of 1,911,022, or nearly 30 gallons per individual, and 240 per inhabited house. But here our calculations must, unsatisfactorily, terminate in the utter want of data for a more minute analysis of this supply, which comprises that for all public and manufacturing purposes, as well as for the domestic use of all classes of the population.

It is worthy of remark that the several companies, in the statements of their affairs made to Parliament, all reckon as capital invested, for which they are to demand a return, not only the money paid up on shares, but all the works executed with reserved funds, derived from the produce of the water rents, imposed without any limit on the public. And it will be seen by the little regard paid, in some instances, to the nominal number and value of shares specified in their several statutes, and the large sums expended out of the water-rates or rents, and not paid up by the subscribers, that they have, to a great extent, been simply little corporations, endowed with power to make the public of their several districts perform the labour of their own supply, and pay them an enormous commission for their kind superintendence; as clumsy a contrivance, so far as the public interests are concerned, as can well be imagined, though not without ingenuity, when regarded in another light.

"It is obvious," states the Commons' Committee's Report of 1828, "that the *quantity* of water supplied in London and Westminster (the metropolis north of the Thames) is abundant; and in our examinations of individuals touching the quality of the water, we have in no instance met with complaints of deficiency of quantity; (i.e. in the neighbourhoods which can pay for it *ad libitum*). We have reason to believe that the hospitals, workhouses, and other similar establishments, where an

1 Companies.	2 Sources of Supply.	3 Number of Shares.	4 Amount paid up on each Share.	5 Total Amount of Subscriptions paid up.	6 Total Estimated Expenditure on the works in 1833.
			Stated at nearly £. s. d.	Stated at £.	£.
New River . . .	Rivers Amwell and Lea.	72	7,000 0 0	500,000	1,116,964
East London . .	River Lea at Old Ford .	4,434	98 8 0	436,139	594,988
Chelsea . . .	Thames between the Red House and the Ranelagh Sewer . .	2,000 2,000 800	20 0 0 10 0 0 12 10 0	70,000	271,311
Grand Junction .	Thames at Brentford .	5,500	37 9 1	206,000	331,174
West Middlesex.	Thamesat Hammersmith	8,300	45 12 0	378,466	404,263
Southwark . . .	Thames at Battersea. .	No	return.	. .	. .
Lambeth . . .	Thames near Waterloo Bridge	960	37 8 4	35,920	182,553
South London.	Thames at Vauxhall Bridge	1,000	98 0 0	98,000	245,306
Kent	River Ravensbourne. .	No	return.	. .	. .
Hampstead . . .	Springs near Caen Wood	No	return.	. .	. .
Totals . .	. . .	..	..	1,724,525	3,146,559
Averages of the Companies returned under each head in 1834 . .				246,361	449,508

Companies.	12 Approximate number of houses in the several districts of supply in 1841.	13 Number of houses and buildings supplied according to return in 1833.	14 Average quantity delivered daily to each house or building in 1833.	15 Mean height at which delivered.	16 Average cost to each of the houses and buildings supplied.
	Inhabited houses.	houses.	gallons.	feet.	s. d.
New River	81,667	70,145	241	91½	26 6
East London	36,916	46,421	120½	60	22 9
Chelsea	16,789	13,892	168	85	33 6
Grand Junction . . .	13,260	8,780	350	100	48 6
West Middlesex . .	21,336	16,000	185	155	52 10
Southwark	10,205	7,100	156	38	21 3
Lambeth	23,754	16,682	124	55	17 0
South London. . . .	19,592	12,046	100	perhaps 50	15 0
Kent	12,187	. .	. .	. .	. .
Hampstead	4,000	. .	. .	. . .	. .
Total	239,706	191,066	. .	. .	. .
Averages . . .	27,940	23,888	180½*	79¼*	29 8*

* These are the averages of the several Companies, but not the true averages for the whole Metropolis, which, however, are readily deducible from the above data. The whole of the data in this Table are derived from the Returns made to Parliament by the several Companies in 1834, with the exception of Columns 7, 9, and 18, obtained by an addition to the analogous Columns of 1833 of one-third, assumed as a fair proportion from the evidence of Mr. Wicksteed, before the Health of Towns Commissioners, that the supplies by the East London Company had been increased 30 per cent. between 1833 and 1843; and likewise the Columns 11 and 12, formed by dividing the population and inhabited houses, computed

to the Metropolis.

7 Estimated yearly supply in 1845.	8 Yearly supply returned to Parliament in 1833.	9 Estimated daily supply in 1845.	10 Daily supply returned to Parliament in 1833.	11 Approximate Population of the several districts of supply in 1841.	Companies.
hhds.	hhds.	hhds.	hhds.	Inhabitants.	
152,866,666	114,650,000	418,812	314,109	637,455	New River.
50,414,125	37,810,594	138,120	103,590	346,783	East London.
21,004,000	15,753,000	57,537	43,178	133,000	Chelsea.
28,936,756	21,702,567	78,930	59,198	105,915	Grand Junction.
26,666,666	20,000,000	73,058	54,794	183,533	West Middlesex.
9,333,333	7,000,000	25,564	19,173	79,479	Southwark.
15,998,133	11,998,600	43,826	32,872	174,375	Lambeth.
9,333,333	7,000,000	25,570	19,178	143,325	South London.
. .	. .	. .	. .	81,157	Kent.
. .	. .	. .	. .	20,000	Hampstead.
314,553,012	235,914,761	861,417	646,092	1,911,022	Totals.
39,319,126	29,489,345	107,677	80,762	226,238	Averages.

17 Cost of Supply per 1000 hogsheads.	18 Estimated yearly produce of water rents in 1845.	19 Yearly produce of water rents returned in 1833.	20 Dividends per share in 1833.	21 Dividends per cent. on total cost of works.	22 Dividends per cent. on paid-up capital.	Companies.
s. *d.*	£.	£.	£. *s.* *d.*	£.	£.	
17 1¼	131,077	98,308	617 0 0	4	9	New River.
28 0	70,748	53,061	5 0 0	3¼	5	East London.
29 0	30,541	22,906	2 18 0 1 9 0 1 16 3	1¼	14¼	Chelsea.
24 1	34,872	26,154	2 10 0	4⅛	7	Grand Junction.
45 6	60,666	45,500	3 0 0	6⅛	7	West Middlesex.
21 0	10,466	7,850	No return.	..	..	Southwark.
24 8	19,744	14,808	4 0 0	2 1/10	10⅔	Lambeth.
25 8¼	12,000	9,000	5 0 0	2	5 1/10	South London.
. .	. .	. .	. .	..	..	Kent.
. .	. .	. .	. .	..	..	Hampstead.
. .	370,264	277,587	. .	..	..	Total.
26 10¼*	46,264	34,698	. .	3⅓*	8⅓*	Averages.

within the Registrar-General's Bills of Mortality for the Metropolis, the limits adopted for which are nearly identical with those of the water supplies, among the several districts of supply portrayed in the map attached to the Second Report of the Health of Towns Commissioners, with a very near approach to exactitude for all except the districts to the south of the Thames, where recent competition has caused the supplies to be inextricably intermingled. The number of houses and buildings supplied evidently includes not only all which have the water "laid on," but all whose inhabitants resort to public stand-cocks, for which rents are paid by the landlords of the poorer classes of houses.

abundance of water is an essential requisite, are in all cases duly supplied; and upon the important subject of supply in case of fire, our evidence leads us to believe, that of late it has always been ample, and that when not immediately procured, the fault has lain with the turncocks; for among other advantages of the reservoirs annexed to the works upon the Middlesex side of the river, is that of having at command a large head of water, by which the mains are kept full, and in many districts are under considerable pressure. The supply of a large quantity of water upon any sudden emergency is thus ensured; and among other great advantages arising out of the substitution of iron for wooden mains, is that of their sustaining the pressure of a column of water, which it would have been impossible, in the former state of the works, to have commanded.

"As far, therefore, as regards the description and quantity of water supplied to the cities of London and Westminster, it appears that more than half the consumption is derived from the Thames; and that it is in such abundance as not only to supply all necessary demands upon ordinary and extraordinary occasions, but that a proportion is constantly suffered to run to waste, by which the cleansing of the drains of houses and of the common sewers is effectually accomplished, all accumulations of filth obviated, and the general healthfulness of the metropolis promoted."*

With regard to the works which supply those parts of the metropolis lying on the Surrey side of the river, the Commissioners observe that "there appear to be no just complaints respecting the *quantity* of water furnished by any of these companies, *except* in cases of fire when there has occasionally been a serious deficiency. We have inquired into the causes of this, and are induced to refer it to the want of proper reservoirs for preserving a head of water on the mains, when the engines are not working. On these occasions, much time is often lost in sending to the engine of the district; and if the steam be not up, further and fatal delay sometimes occurs."† The justice of this observation receives almost annual proof, in some dreadful conflagration among the great warehouses, manufactories, &c., of the most crowded parts of Southwark. Out of 459 recent fires on the south side of the river, the water, it was stated by Mr. Braidwood to the Health of Towns Commissioners, was either late, or deficient in quantity at 107; while during the same period, there were 1529 fires on the north side, at nine only of which the water was not ready, or the supply short.

It must be borne in mind, at the same time, that although the supply may be abundant to those who can and will pay for it, the arbitrary rates of the companies may completely prevent a sufficient use of it by the poor; and some of the evidence before the Health of Towns Commissioners expressly declares such to be the case. The rents are not uniform; but a usual price is 16*s.* for a small four-roomed house, if the landlord pays the rate, and 20*s.* if the tenant pays, or 8*s.* a-year for each family, supposing there to be a family in every two rooms. It is laid on three times a-week, for two hours each time. The tenants buy a butter-tub for 1*s.*, with wooden hoops, which holds eight gallons.

* Report of Commissioners on the Supply of Water in the Metropolis, 1828, pp. 5, 6.

† Ibid., p. 6.

This they fill, and though they may take as much as they please, they take no more. Their consumption, therefore, is only 24 gallons per week. Some few buy pork-tubs, which hold 42 gallons; and still fewer may have wine-pipes, of 110 to 125 gallons; the former costing from 2*s.* 6*d.* to 3*s.*, and the latter from 16*s.* to 1*l.* A family is content to pay 8*s.* a-year, or 1¾*d.* a-week, and should consume about 140 gallons, but they will not take enough.* In all the poorest parts of the town, however, the houses are destitute of such a supply. Pipes to each cannot be afforded; and the inhabitants get their water from common cast-iron stand-cocks, each supplying a whole street or neighbourhood. In the east of London, there are more than 500 of these common cocks. The rates for these cocks are paid by the landlord.† "A copious supply of water to the poor can, in my opinion," states Mr. Wicksteed, "*be given by a public body only;* for supposing that in towns at present supplied by trading companies a supply were required for the poor, and that each parish were rated high enough to raise a sufficient sum annually to pay for a given number of common stand-cocks, it would be a very difficult matter to prevent the inhabitants generally from taking a supply from the cocks, and if this were not prevented, the rental of the company would soon be reduced."‡

"Although there is no portion of the town," state the Health of Towns Commissioners, "into which the mains and pipes of some water companies are not carried, yet we find that large numbers of the houses of the poorer classes receive no supply. In the district supplied by the New River Company, containing about 900,000 persons, about one-third are unsupplied; and in the district of the Southwark Company, 30,000 persons have no supply, although the pipes of more than one company are carried into some parts. A still greater proportion can obtain water only from stand-pipes, common to a large number of persons, and supplied only at intermittent periods. We have already pointed out the evils of this system, and we have no reason to believe them to be less injurious in London than elsewhere. They are attributable to the same causes,—the natural reluctance of the companies to supply the poor except through the medium of the landlord, and the expense of a separate cistern or water-butt for each house necessarily entailed by the system of intermittent supply.

"Our attention has been especially called in the Metropolis to the necessity of securing a liberal supply of pure water to the poorer classes by pipes, and rendering them independent of pumps and wells. The practice, hitherto almost universal, of retaining all refuse in cesspools beneath houses has, in many parts of the Metropolis, so entirely saturated the soil with injurious matter, as to render unfit for use the water obtained from pumps and wells. To this cause of injury may also be added the pollution from the escape of gas: this is not, however, confined to the wells; the water in pipes does not escape contamination from this cause. Mr. Mylne presents instances of such evils, and gives an example of the number of gas-pipes, belonging to competing companies, that are frequently found traversing the same streets. He states

* W. Gravatt, 4358; Charles Bratt, 1786; Hugh Biers, 1824; First Report, Health of Towns Commissioners.

† Wicksteed, 4511; Health of Towns Commissioners.

‡ Ibid., 4483.

that the whole of the soil is in some streets so completely saturated with gas, that if the boxes of the fire-plugs are covered for a few hours, the coal-gas collects so abundantly within them, as to ignite on the application of a light. This effect has been witnessed by members of this Commission. We are not prepared to offer an opinion how far this nuisance may be lessened by additional care in forming the joints of the pipes; but the facts adduced before us appear to afford reasons for consideration whether some means should not be adopted for regulating the number of gas-pipes to be laid in any one street. Most of the gas companies are already liable to be placed under regulations with regard to the mode of their supply. In the Acts for the establishment of gas as well as water companies, clauses are usually inserted to prevent the laying down of gas-pipes within four feet of the water-pipes, and making other provisions for security against the contamination of water. A system of constant supply, to which we have so frequently adverted, by keeping the water-pipes continually full, would materially contribute to prevent the indraught of the gas."*

With regard to the quality of the waters at the several sources of supply, the Report of the Commissioners appointed nearly 20 years ago applies with as much force to the present state of affairs, as to that which they found existing in 1828; for while the eastern part of the town is supplied with the waters of the Lea, taken from Old Ford, and the central, with those of the New River, and the Thames, at Broken Wharf, every portion of it to the west of Charing Cross, is still supplied with Thames water, taken from the tideway, either at the mouth of the great Ranelagh sewer, at Hammersmith, or at Brentford; and every part of Surrey, with the like mixture of all vile compounds, taken at Pedlar's Acre, near Waterloo Bridge, at Vauxhall Bridge, or at Battersea; the only difference being that the impurity of the supplies derived from the Thames is yearly augmented by the increasing population on its banks, the more general discharge of fæcal matter by the sewers, and the more constant disturbance of the river by multiplied steam-boats.

"Assuming the supplies to be derived directly from the river, and to be subjected to no intermediate process tending to purification, it is sufficiently obvious that the state of the weather will materially affect the purity of the water, which is sometimes comparatively clean and clear, and at others loaded with various matters in mechanical suspension, rendering it more or less coloured and turbid. In the latter state, when thrown into cisterns and other receptacles of houses, it is manifestly unfit for immediate use; but after being allowed to rest, it forms a certain quantity of deposit, and thus may become sufficiently clear for ordinary purposes. This deposit, however, is the source of several evils; it renders the cisterns foul, and runs off into those pipes which issue from or near the bottom of the reservoirs. By the agitation which accompanies every fresh influx of water, this deposit is constantly stirred up, and becomes a renewed source of contamination to the whole mass; and although chiefly consisting of earthy substances in a state of minute division, it is apt also to contain such proportion of organic matters as will occasion a degree of putrefaction when collected together in any quantity, and especially in warm weather. Of this deposit, more or less is always collected, especially where the service is direct from the river;

* Second Report of the Health of Towns Commissioners, pp. 71, 72.

and although some of the companies have reservoirs of such magnitude as to enable them to serve water already purified by deposition, the system is still very imperfect, and the water is frequently supplied in a turbid state. In other cases, the companies' reservoirs, however eminently useful in cases of fire, become objectionable in regard to the purity of the water, since the mud accumulates in them, and also proportionately in the mains and branch pipes.

"By far the greater number of complaints which have been made to us with respect to the quality of the water have originated in the cause just alluded to, and hence some of the companies have attempted to get over the difficulty, by suffering the water to remain at rest for a sufficient time, to become clear before the public are supplied; and in this they have in some instances so far succeeded as materially to improve their service. When, however, from land floods, or other causes, the river is very thick, they cannot allow due time for such subsidence; and even when most perfectly performed, the insects contained in the water, so far from being got rid of, become, perhaps, even more numerous. This is another just cause of complaint in regard to the water, especially in hot seasons. To obtain an effectual supply of clear water, free from insects, and all suspended matters, we have taken into consideration various plans for filtering the river water through beds of sand and other materials; and, considering this, on many accounts, as a very important object, we are glad to find that it is perfectly possible to filter the whole supply, and this within such limits in point of expence as that no serious objection can be urged against the plan on that score, and with such rapidity as not to interfere with the regularity of service.

"It must, however, be recollected, that insects and suspended impurities only are separated by filtration, and that whatever substances may be employed in the construction of filtering beds, the purity of the water as dependent upon matters held in a state of solution cannot be improved by any practicable modification of the process. If, therefore, it can be shown, that water taken from the parts of the river whence the companies draw their supplies either is, or is likely to be contaminated by substances dissolved, or chemically combined, it will follow that the most perfect system of filtering can effect only a partial purification.

"In order to ensure the subjecting of all the various specimens of Thames water (which had been taken from the river with great care and under a variety of circumstances) to the most careful and rigid examination, upon one uniform system, we put them, for that purpose, into the hands of Dr. Bostock, a gentleman eminently qualified for the task by his extensive knowledge of chemistry, and his practical experience in this department of analysis. In his report to us he justly remarks that it would have required a much longer space of time than was allowed him to have performed a complete scientific analysis of so many specimens of water; but the results he obtained are quite sufficient for the object proposed, and to which we more particularly directed his attention, namely, "to ascertain how far the water of the Thames, contiguous to or in the neighbourhood of London, is in a state proper for being employed in diet and various other domestic purposes."

The general conclusion he deduces from the whole series of examinations is expressed in the following passage of his report:—

"It appears that the water of the Thames, when free from extraneous

substances, is in a state of considerable purity, containing only a moderate quantity of saline contents, and those of a kind which cannot be supposed to render it unfit for domestic purposes, or to be injurious to the health; but as it approaches the metropolis it becomes loaded with a quantity of filth, which renders it disgusting to the senses and improper to be employed in the preparation of food. The greatest part of this additional matter appears to be only mechanically suspended in it, and separates by mere rest. It requires, however, a considerable length of time to allow of the complete separation; while, on account of its peculiar texture and comminuted state, it is disposed to be again diffused through the water by a slight degree of agitation, while the gradual accumulation of this matter in the reservoirs must obviously increase the unpleasant odour and flavour of the water, and promote its tendency to the putrid state.

"Regarding the greatest part of the extraneous matter in the Thames as mechanically mixed with it, we may conceive that a variety of incidental circumstances will affect its quantity in the same circumstances of the tide; but the observations are sufficiently uniform to warrant us in concluding that the water is in the purest state at low tide, and the most loaded with extraneous matter at half tide. It would appear, however, that a very considerable part, if not the whole, of this extraneous matter may be removed by filtration through sand, and still more effectually by a mixture of sand and charcoal.

"We have also endeavoured to gain information from various other sources respecting the state and purity of the Thames water and its general fitness for domestic use; and from such inquiries it appears proved to us, that the quality of the water within certain limits, included in what may be called the London district, has suffered a gradual deterioration within the last 10 or 12 years. We found this opinion upon the well ascertained fact of the disappearance of fish from those parts of the river to such an extent as to have led to the almost entire destruction of the fisherman's trade between Putney Bridge and Greenwich, and upon the circumstance that the eels imported from Holland can now with great difficulty be kept alive in those parts of the Thames where they were formerly preserved in perfect health. We also learn that the fishmongers in London find it impossible to preserve live fish for any length of time in water taken from the same district.

"The causes of these effects are, perhaps, principally to be traced to the increase of certain manufactories, amongst which those of coal gas are the most prominent, polluting the river by their refuse; to the constant passage of steam-boats, by which the mud is stirred up; and to the peculiar nature of that mud within the above-mentioned precincts. The very circumstance, also, of the great abundance with which water is supplied to the houses and manufactories of the metropolis, appears to be essentially connected with the augmented impurity of the river; for where refuse animal and vegetable matters of various descriptions used to be collected, and from time to time removed for the purposes of manure, it is now indiscriminately washed into the sewers and conveyed into the Thames, and the sewers themselves are rendered much cleaner than formerly by the quantity of water which runs to waste, and which, as already remarked, has rendered them less offensive, especially in those parts of the town where they used to be most liable to stagnation and

consequent putrescence. Thus it has been stated to us that the water of the river is more polluted immediately after heavy rains, which force down the contents of the sewers, than after a continuance of dry weather, when its course is sluggish or altogether arrested; and the results of experiments we directed to be made on the subject fully establish this fact. The great increase which has of late years taken place in the population of London, and of its suburbs on every side, must also be attended by a proportionate augmentation in the quantity of extraneous matter carried down into the Thames.

"There are other circumstances affecting the fitness of the water, as now taken from the river, for the supply of the town, which, though less general in their influence, should not be overlooked; such as the position of the suction pipes of the engines belonging to some of the companies in regard to the mouths of sewers, the quantity of dead animals thrown into the river in and about London, its contamination by the offal of slaughter-houses, and a variety of other causes which we need not here specify, but which will be found on reference to the evidence. Some of these we have inquired into in detail, and have anxiously sought for means by which the nuisances in question might be remedied or abated; but it is manifest that if the general quality of the river water be objectionable within the whole of that district whence the supplies for the metropolis are drawn, any remedies for local evils become comparatively unimportant, and although these diminish as we ascend the river, we apprehend that their influence, with that of the other contaminating causes, will be more or less *felt nearly to the extent to which the tide reaches.*

"The statements which have been made respecting the insalubrity of the Thames water, as supplied by the companies, have also been considered by us; and although from the few cases which have been brought before us of disorders imputed to this cause, we do not feel ourselves warranted to draw any general conclusions, we think the subject is by no means undeserving of further attention. There must always be considerable difficulty in obtaining decisive evidence of an influence, which, although actually operating to a certain extent as a cause of constitutional derangement, may yet not be sufficiently powerful to produce immediate and obvious injury. It cannot be denied that the continued use of a noxious ingredient in diet may create a tendency to disorders, which do not actually break out until fostered by the concurrence of other causes; for we unquestionably find an influence of the same kind exerted by other agents, which occasion merely a certain predisposition to disease, and of which the immediate operation must, therefore, be extremely insidious and difficult to trace. *It is obvious that water receiving so large a proportion of foreign matters as we know find their way into the Thames, and so far impure as to destroy fish, cannot, even when clarified by filtration, be pronounced entirely free from the suspicion of general insalubrity. In reference also to this question, we apprehend that there are no grounds for assuming the probability of any improvement in the state of the water drawn from the London district of the river.*

"Although the principal supply of water by the New River Company is not open to the same objectionable impregnations as that of the Thames, we think it, nevertheless, susceptible of much improvement.

The occasional deficiency in quantity which suggested the necessity of the engine at Broken Wharf, might be obviated by allowing a portion of that supply to be drawn from the River Lea, at Lea Bridge.

"But here, as in respect to the Thames, the water is occasionally very muddy, receiving, as it does, the drainage of a considerable extent of country, in consequence of a right claimed by the proprietors of adjacent lands, and which the Company have, at present, no means of obviating; neither have they any power to prevent persons from bathing in their aqueduct.

"These evils they would very gladly remedy, if enabled to do so; and their removal, together with the adoption of an extensive system of filtration, would materially contribute to the perfection of the New River supply. Great benefit would result, not only to the extensive district of London supplied by this Company, but also to the public at large, if the inducement to bathe in the open canal of the New River were superseded by the establishment of baths in the neighbourhood of the metropolis, to which the public might, under certain regulations, be allowed access. It has been stated to us in evidence, that the New River Company have voluntarily offered to furnish sufficient supplies of water for a purpose of such manifest and general utility.

"Taking into consideration the various circumstances to which we have now adverted, together with the details of evidence by which they are proved and illustrated, and also the facts derived from our own observation and experience, *we are of opinion, that the present state of the supply of water to the metropolis is susceptible of and requires improvement; that many of the complaints respecting the quality of the water are well founded, and that it ought to be derived from other sources than those now resorted to, and guarded by such restrictions as shall at all times ensure its cleanliness and purity.*"*

From this abstract of all authentic information on the subject, we may, I think, gather:—

That the supply of water to the metropolis, from the earliest period of its history down to the commencement of the 17th century, was a municipal duty of the corporation.

That the system of supplying water by companies commenced in the farming out of this duty by the corporation within the city, in which course they were subsequently imitated by Parliament without its limits, as the increase of buildings offered chances of profit to private capital.

That such companies ought never to have been allowed a separate municipal existence, by which, instead of being mere contractors under the local authorities, they have been enabled to constitute themselves independent corporations, using extensive powers of taxation and administration, with comparatively limited capitals of their own investment, but with every private interest which could lead them to oppose that of the public and neglect the poor consumer.

That their history exhibits a constant perversion of their great powers to the public injury and annoyance, alternately in tearing up the streets and wasting the capital raised by their water rents, not to supply neglected

* Report of Dr. P. M. Roget, William Thomas Brande, Esq., and Thomas Telford, Esq., Commissioners appointed by His Majesty to inquire into the State of the Supply of Water to the Metropolis, dated April 21, 1828. Sess. 1828, No. 207, pp. 7–11.

districts, but to get from a rival company the rich consumers already supplied, and then making mutual treaties to levy a monopoly price on these consumers, whom they assume to make over to each other's mercy.

That the parliamentary limitations on the profits of the several companies are quite deceptious, so long as they continue to charge as capital invested, for which they require a return, not only their own paid up capital, but such moneys raised by their water rents as have been invested in extensions of their works; amounting in one instance, even ten years ago, to more than five times the paid up capital.

That the arming of private companies with all the powers of local taxation and administration, has necessarily produced results as adverse to the interests of the public in regard to the quality, as to the cost of the supplies; the whole of the metropolis, in spite of 20 years of agitation, being still supplied with water from the foul tideway of the Thames, with the exception of the eastern end of the town, which enjoys the waters of the Lea, polluted only by the drainage of Hackney, &c.; and the central parts east of Tottenham Court Road and Charing Cross, which have those of the New River, except in times of drought, when they receive those of the Thames from the mouths of the metropolitan sewers.

That, while Parliament shall vainly encourage a system of competition among irresponsible companies, thus armed for individual oppression, and unlimited in number,—a system as injurious when carried into effect as when virtually superseded by mutual treaties of monopoly,—none of those great improvements can be made in the supplies, which are equally required for the health and safety of all classes, and the comfort, cleanliness, and character, of the poor.

That the Thames itself *above its tideway*, the Wandle on the south side of the great metropolitan valley, and the Verulam on the north of it, offer boundless supplies of pure, soft, and wholesome water, which properly constituted authorities for the supply of the metropolis might bring into and distribute throughout it, to every house, whether of the poor or the rich, at an outlay the interest of which would be far less than the sums which will be levied on the community by the companies for supplies at once bad and defective.

That, to allow a fair interest for the paid-up capital of the existing companies, whose operations have always been sanctioned by Parliament, is a necessary part of any such operation on behalf of the public, as likewise to employ, or part pension, their paid officers, as suggested by one of them in his evidence before the Health of Towns Commissioners, already quoted; charges which would purchase the existing machinery of distribution, and prevent further extravagant waste in its reduplication; a waste which will otherwise inevitably occur, and be charged upon the public by subsequent treaties of monopoly.

And that, with *constant* supplies thus brought to every door by the public authorities, it will be easily practicable, by sanatory laws, to compel the owners of tenements for the poor to have the water laid on in every habitation, with sinks and drains proper for its ample use; and to carry out the many other valuable suggestions for the advantage of the public health, and especially that of the poorer classes in the Metropolis, made by the medical, engineering, and architectural witnesses before the Health of Towns Commissioners, and contained in their valuable volumes recently laid by command before Parliament.